Analysis of cholesterol lipoprotein separations in Holstein dairy cattle by anion-exchange high-performance liquid chromatography

Abstract of Doctoral Thesis

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Lipid metabolism in dairy cows are significantly active for during the transition period. Recently, anion-exchange (AEX) high-performance liquid chromatography (HPLC) methods are recently developed and can measure serum lipoproteins such as total cholesterol, HDL-C, LDL-C, IDL-C, and VLDL-C with rapid, high isolation efficiency in humans and rabbits. However, AEX-HPLC analysis has not been applied in dairy cows. Therefore, the current study investigated the basis examination whether AEX-HPLC methods could measure bovine lipoprotein fraction. Elution peaks of HDL-C and LDL-C by AEX-HPLC analysis were separated specifically. Analytical evaluation of HDL-C and LDL-C with intra- and inter-assay CVs were below 10 %, respectively. Excellent linearity was demonstrated with HDL-C and LDL-C of the dilutions tested. Furthermore, positive correlation coefficients between the values of total cholesterol, HDL-C, and LDL-C were determined between AEX-HPLC and ultracentrifugation methods and between AEX-HPLC and GP-HPLC. Therefore, these results suggest that AEX-HPLC would be a useful method for evaluating the lipoprotein fraction in dairy cows.

The lipoprotein fraction in dairy cows with different lactation stages measured by AEX-HPLC methods were compared between fineness S daily farmer (superior of milk quality performance and reproduction performance) and poor I daily farmer in Miyagi prefecture. Significant difference was observed in changes in LDL-C/Total-C (%) between 2 daily farmers. LDL-C/Total-C (%) increased from early lactation to mid lactation, and thereafter decreased from mid lactation to late lactation in S dairy farmers. Meanwhile, LDL-C/Total-C (%) did not show any significant changes during lactation stages in I dairy farmers. These results suggested that metabolic pathway of VLDL→IDL→LDL is activated by transferring the triglyceride to mammary gland for plenty milk production in S dairy farmer.

We focused on the lipid metabolism during transition period. Firstly, for creating a reference value, the changes in lipoprotein fraction in 10 healthy

daily cows during transition period were evaluated by AEX-HPLC method. Secondarily, we compared lipoprotein fraction between healthy dairy cows and 19 dairy cows with perinatal disease. LDL-C and HDL-C showed trend of low levels for fatty liver and milk fever group. It was indicated that low LDL-C showed decreased fat evacuation from liver by VLDL, therefore we might have access to LDL-C for curative interposition.